

paraffin, the anticipated life of the reservoir, difficulties in treating, and other factors.

One of the most important factors that must be determined from the beginning is how hard it will be to remove enough water to sell the oil. If the API gravity of the produced oil is high, this separation is usually relatively simple because the crude oil is thin and flows easily. A three-stage separator or the addition of a wash tank is all that is needed.

If the crude oil has a low gravity, very little water is flash removed (removed in just a few seconds or minutes) or is difficult to remove. Additional vessels and processes will have to be considered for the operation. Once the installation requirements are determined, the flow line can be laid and construction of the tank battery can begin.

D-2. The Flow Lines and Header.

As the flow lines enter the tank battery, they are usually aligned and oriented with the vessels so that they are parallel to each other and approximately 18 inches apart. The distance apart is governed by the makeup arrangement of the header. By using a 12-inch nipple and two tees as the header is made up, the line separation will be established at 18 inches. Flow lines may be of steel, plastic, or fiberglass. The last fittings in the flow line before it connects to the header are an optional valve, a 6-inch nipple, a union, another 6-inch nipple, a required check valve, and another 6-inch nipple. At this point, the flow line enters the header tee.

When an oil leak or line break occurs in the flow line, the check valve is the only safety device to prevent the emulsions from all of the wells that produce through the header from flowing back and being lost on the ground. If the check valve at the tank

battery header should fail and the casing check valve at a near-by pumping well also fail, it is not unusual for most of the daily production from all wells to be lost downhole into the offending well. In addition, there are no indications of any problem when inspecting the system. The well will show good, strong pump action at the bleeder valve, although the well is just circulating.



Figure 2. Flow lines entering the header. Often the lines are numbered like these for easy identification.

The header. The purpose of the header is to control which crude oil system each well flows through as the oil progresses through the system on its way to the oil holding tanks.

When the tank battery has only one well, a simple system is provided. When it is a marginally producing well, the system is small, and, because a lot of time is available to treat oil, the lease pumper can usually treat and sell the oil successfully with minimal facilities.

When all of the production is marginal, the cost of constructing a second production system may never be justified, and the treating system is a barrel test, a bucket test, or an individual well tester.

The important consideration in designing the header is to stand the valves up where they can be inspected at a glance to determine if each valve is open or closed. If the valves are controlled by automation, a *tattletale* or indicator of some style is usually included in the valve design for visual inspection in determining if it is open or closed. As a rule, multiple round opening valves are never used when designing a header because they lead to mistakes in settings and production problems, loss of production, and spills. Well numbers should be indicated on all header lines.

There are several popular styles of headers, and many of them are described in this manual. Any chosen style is good as long as the valves are easy to understand. Normally, headers are designed with only a **production** header and a **test** header. When a great number of wells are producing to a single battery, this number will be increased to three with the wells producing through two **production headers**, and **one test header**.

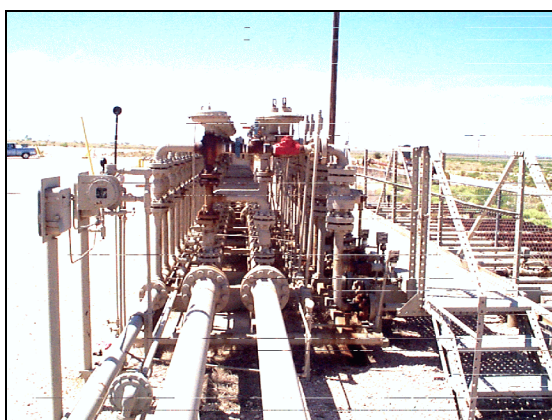


Figure 3. A three-line header with a four-inch test line (left).

D-3. Chemical Injection at the Header.

Chemical is injected at the tank battery at a location after the header but before the first

vessel. This is usually just ahead of the separator. The chemical is added after the header to ensure that the produced oil gets chemical in the event one or two wells are shut in. On large, high-production installations, the chemical will be mixed well regardless of where it is injected.

Some chemical injectors are simple injectors attached to a barrel on a stand. With stripper production, this is still common. The larger installations being connected at tank batteries today have a low tub to catch any drips that may develop. Federal law requires that any tank with a volume of 600 gallons or greater have secondary containment. The chemical is usually in fiberglass tanks on a stand. A sign instructs the field personnel on the type of chemical being used, and a tube storing written literature about the chemical is attached to the stand. A truck will come by on a schedule and add chemical to the tank as needed.

Two chemical injection systems are shown in Figures 4 and 5. The first features the simple pump system that has been common for more than the past fifty years.



Figure 4. A chemical injection system using a barrel and pump.

The system shown in Figure 5 represents the latest style of installation that meets present requirements for high-volume installations. Note that the system includes several features to enhance safety and environmental protection. Beneath the chemical tanks is a drip and leak collection pan. The sign beneath the tank on the right identifies the chemicals and warns of their hazards. Additional information is contained in a tube next to the tank. This system works particularly well with large headers. Chemical treatment is always required for hard-to-treat oil, so this system will continue to be used for many more years.



Figure 5. The chemical injection system for a large tank battery with injection at the header.